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FIRE SAFETY IN HEALTH CARE PREMISES

General Fire Precautions

83

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Health Technical Memorandum Number 83

Fire Safety in Health Care Premises
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Health Technical Memorandum

Fire Safety in Health Care Premises
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Introduction

This Technical Memorandum is intended as a guide for Nominated Officers (Fire), Fire Prevention Officers and others with a responsibility for fire precautions in the National Health Service. Some chapters are of special interest to particular disciplines as will be evident from the contents page. Whilst much of the content relates to hospitals, the principles propounded apply also to other health care premises.

This Memorandum, together with related technical memoranda on design and certain specialist aspects of fire safety and the booklet "Fire Risks Associated with Furniture, Furnishings and Textiles" issued by the Supply Division of the Department of Health & Social Security, constitutes the "Memorandum of Guidance" to which reference was made by the Home Secretary in a Statement[a] in the House of Commons on 23 April 1980. As such, it supplements the draft Home Office Guide on fire precautions in hospitals.

This Memorandum replaces Sections II, VIII and IX of Health Technical Memorandum number 16.

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[a] Hansard, Written Answers, 23 April 1980, cols. *139–141.*

1 General

Scope

1.1 This Memorandum deals with the importance of fire precautions in health care premises. In particular, it draws attention to the key role of management in devising and implementing policies and plans for dealing with the threat posed by fire and for ensuring that all staff receive appropriate training in fire safety. The important part which staff have to play in fire prevention and in responding promptly and effectively should a fire break out is also discussed.

1.2 Guidance is provided on the use and storage of flammable substances and on the fire hazards of particular hospital departments.

Background

1.3 Of the numerous hazards to life, fire has a special place in human imagination. Few people have first hand experience of a serious fire yet all appreciate the threat it presents and the terror it brings when an outbreak is out of control. This innate horror of fire and its consequences is heightened when patients are involved; therefore, those in charge of hospitals and other health care premises have a special responsibility in relation to fire safety.

1.4 Between 2,000 and 3,000 fires occur in hospitals each year. About half of these fires start in wards and in other patient areas and most are caused by the careless disposal of cigarettes and matches and by deliberate fire raising. For further details see Appendix 1.

1.5 In recent years about 10 people have been killed and 50 injured annually in hospital fires. Occasionally, a very serious fire occurs such as that at Coldharbour Hospital in 1974 when 30 patients died. A "life risk" fire is one which leads to casualties, rescues, escapes or evacuation; nearly 70 per cent of such fires start in wards and other places used by patients. On average, there is one "life risk" fire in hospitals every six days.

1.6 Whilst most hospital fires do not spread beyond the ward or room in which they start, the damage they cause is still an unwelcome drain on resources. A fire which is confined to the room of origin can easily cause £1,000 worth of damage and much more if specialised equipment is involved. Losses through fire damage in the National Health Service are estimated to exceed £1 million annually; in addition, there are the indirect costs of disruption to services.

1.7 Health Technical Memoranda 81, 84 and 85 deal with the importance of structural fire protection but however successful this form of protection can be made it plays its part only when a fire has taken a hold. Equal, if not greater, attention should be paid to fire prevention measures, the need for a speedy and effective response to a fire outbreak and to the provision of suitably fire retardant furniture, furnishings and textiles. Measures of this kind will greatly improve the level of fire safety at a relatively low cost but they must be seen as a complement to, rather than a substitute for, structural fire protection.

1.8 Fire safety in the National Health Service is the concern of everyone. All have a responsibility to understand the characteristics of fire and smoke, to know the fire hazards of their working environment, to practice and promote fire prevention and to know the right action to take if a fire breaks out. Due attention to fire precautions will reduce the number of outbreaks, save lives and make more money available for patient care by reducing the amount which has to be spent on restoring fire-damaged buildings and equipment.

2 Fire precautions policies, staffing and training

Fire precautions policies

2.1 Health authorities are expected to have a clearly defined fire precautions policy. They are also required to have plans for dealing with a fire outbreak; these plans should preferably be integrated with the overall security and emergency arrangements. (See HC(78)4–WHC(78)24 in Wales.)

2.2 Policies and plans should be reviewed regularly so that physical changes in the hospital structure, changes of function and other matters which have a bearing on fire safety can be taken into account.

2.3 Plans for dealing with a fire emergency will vary according to the circumstances of individual premises. Checklists of the various items which should feature in a fire emergency plan are included in Section 2 "Plan of Action" of the Fire Precautions Development Programme—a set of aids to fire precautions planning and training which is obtainable from the NHS Training Aids Unit, Hydestile Hospital, Godalming, Surrey, GU8 4DQ.

Staffing levels

2.4 An adequate number of staff who have received sound training in fire precautions is the best first-line defence against fire. This is particularly important at night. Staffing levels will be related to clinical and other operational needs and the availability of staff will have to be considered when formulating fire plans.

2.5 The provision of an adequate number of specialist fire prevention officers is a matter which health authorities need to consider in the light of their particular circumstances. Paragraph 19 of HC(78)4 (WHC(78)24 in Wales) refers.

Staff training

2.6 Health authorities are required to provide training for staff in fire prevention and in how to respond to a fire outbreak. The importance of effective training cannot be overstated. Because fire and smoke can develop so rapidly and cause confusion and fear, training should emphasise the need for a speedy and disciplined response if an outbreak is discovered. Basic fire precautions should be included in "induction" training for new staff so that they may know the basic course of action in the event of a fire:

Raise the alarm.
Remove patients in immediate danger.
Fight the fire if it is safe to do so.
Evacuate the area.
Close all doors.

2.7 Further training should be provided to cover the subject in more depth and to meet the special needs of particular categories of staff. All staff, including part-time and agency staff, should attend a fire precautions training course at least once, but preferably twice, a year. The need to provide training for staff on night duty is particularly important in view of the reduced level of staffing which pertains at this time. Records should be kept of the staff attending courses, the duration of the courses and the nature of the training given in order to identify those staff still in need of training.

2.8 Managers of all disciplines have a duty to ensure that they and their staff attend fire precautions training. They should also make their staff aware of any special hazards and other features of their workplaces which relate to fire and of the procedures to be followed in the event of an outbreak, including those for evacuation and/or escape.

2.9 Effective fire precautions training will enable staff to learn and practice not only the basic course of action but also the following:

2.9.1 The reason for fire and smoke compartmentation of buildings and for protected escape routes to the open air.

2.9.2 The importance of ensuring that the function of fire/smoke doors is not defeated by the dangerous practice of wedging them in the open position.

2.9.3 The dangers of allowing doors on escape routes to be locked without ready access to a key.

2.9.4 The need to be familiar with escape routes (and the need to keep them free of obstruction), site layout, internal layout and communications of the buildings in which they work and reside so that if a fire breaks out they can escape or help others to escape.

2.9.5 The behaviour of fire, smoke and toxic gases.

2.9.6 The fire hazards of their environment and the need for vigilance.

2.9.7 How to recognise the signs of fire.

2.9.8 How to raise the alarm and how local procedures for dealing with a fire operate.

2.9.9 In general, when and how to tackle a fire, which fire appliance to use, how to operate it and, equally important, when to leave fire fighting to the Fire Brigade.

2.9.10 The circumstances under which patients should be removed to a place of safety and how evacuation should be carried out.

2.10 The effectiveness of plans for dealing with a fire outbreak and of various aspects of fire precautions training should be tested by practice fire drills both during the day and at night. The frequency of such drills and their nature is a matter for local management but it is recommended that they take place at least twice a year and simulate conditions in which at least one of the escape routes is obstructed.

2.11 The following chapters deal with the various aspects of fire prevention and there is a chapter on the action to be taken in the event of a fire. They are not intended as an exhaustive check-list for training purposes but nevertheless they may be of assistance to those concerned with fire precautions training. A comprehensive fire precautions training manual is included in the Fire Precautions Development Programme referred to in paragraph 2.3. This manual is designed to be readily adaptable to meet local requirements. In addition, the NHS Training Aids Unit provide courses in training skills for fire prevention officers and also have available an "information pack" on training equipment and other related matters.

Fire notices

2.12 At conspicuous positions in all parts of hospitals and other health care premises, clear notices should be exhibited which state concisely, the main essentials of the action to be taken upon discovering a fire and on hearing an alarm. In addition, notices giving more detailed instructions should be exhibited in staff rooms, staff residential accommodation and on notice boards. Local circumstances will determine whether fire notices should be multi-lingual.

2.13 Some authorities have found that the issue to staff of a booklet which provides, in concise and easily understood terms, advice on fire prevention and the action to be taken in the event of a fire, a good means of raising the awareness of staff to the dangers of fire.

3 Fire prevention

General

3.1 The likelihood of fires starting can be reduced significantly by suitable preventive measures. Good practice in fire prevention is largely a matter of awareness of the ways in which fires can start and of orderliness and tidiness in day to day activities.

3.2 Attention to the fire hazards of smoking, the possibility of deliberate fire raising and the need for "good housekeeping" are among the most important aspects of fire prevention in hospitals.

Smoking

3.3 Observance of the following should contribute to a reduction in the number of fires caused through smoking:

3.3.1 Vigilance is essential to ensure that smokers do not cause fires by the careless disposal of cigarettes and matches or by falling asleep after lighting a cigarette. Elderly patients are a particular hazard in this respect.

3.3.2 Where smoking is permitted, there should be plenty of ashtrays or bins for the safe disposal of cigarettes and other smokers' materials.

3.3.3 Day rooms and other places where smoking is permitted should be inspected about half-an-hour after they are vacated for the night to ensure that discarded cigarettes have not ignited other materials.

3.3.4 "Smoking" and "no smoking" areas should be clearly marked by appropriate signs. Smoking should be prohibited in kitchens, stores and in parts of buildings where readily flammable substances may be a hazard.

Deliberate fire raising

3.4 A significant proportion of hospital fires is started deliberately. Deliberate fire raising is a particular hazard of psychiatric hospitals, but it is by no means unknown at other hospitals where intruders, bent on vandalism, have set fire to buildings without regard to the consequences.

3.5 Alertness on the part of staff to suspicious actions by strangers and to the activities of known fire raisers amongst patients, the securing of premises and prompt removal of combustible rubbish will help to frustrate the activities of those who start fires deliberately.

"Good housekeeping"

3.6 Attention to matters commonly referred to as "good housekeeping" can reduce the likelihood of fires occurring. The following basic practices should therefore be observed:

3.6.1 Adopt orderly methods of stacking in stores where linen, paper and cartons are used and thereby reduce the risk of a fire and of it remaining undetected.

3.6.2 Store equipment and packages in properly appointed areas, not in corridors or lobbies and *never* in an escape route near a fire exit or fire fighting equipment.

3.6.3 Avoid placing anything over heaters to dry; this practice blocks the heat-dissipating surfaces and vents and can lead to a dangerous build-up of temperature.

3.6.4 Avoid the accumulation of rubbish. "Out of sight" spaces, e.g. lift shafts, behind radiators, basements, dead-end corridors, should be checked for litter and any waste found should be removed.

3.6.5 Keep work-places, machinery and equipment clean. In particular, avoid the accumulation of fluff and grease deposits in laundries, kitchens and similar areas.

3.6.6 Put cleaning rags and materials in a non-combustible container after use.

3.6.7 When leaving places of work, check for possible causes of fire, e.g. electrical equipment left on or plugged in, gas appliances alight or gas taps left on. Secure doors and windows against intruders.

3.6.8 Never use unfused multiple point adaptors on socket outlets without the agreement of the hospital engineer.

3.6.9 Never tamper with electrical equipment. Fuses, including those in plug tops or on equipment, should be renewed only by an electrician.

3.6.10 Check electrical cables and cords frequently for signs of wear. If wear is apparent, tell the maintenance staff immediately; unqualified staff must *not* effect temporary repairs.

Combustible waste

3.7 Paragraphs 3.8 to 3.15 below relate only to the fire precautions aspects of waste disposal.

3.8 There should be an efficient routine for the collection and disposal of combustible waste including packing cases, packing materials and workshop waste. It is preferable that such waste is burned in an incinerator or disposed of in a compactor unit.

3.9 It is usually convenient to dispose of waste collected over a 24-hour period during the normal working day. This will entail the provision of safe storage of waste awaiting disposal, e.g. metal bins with well-fitting lids.

3.10 Regular collections of rubbish from particular disposal points should be arranged and staff encouraged to leave waste materials in the correct containers only at these points. Ideally, there should be at least one such disposal point for each department of a hospital.

External areas

3.11 Rubbish in external areas is a significant fire risk. An accumulation of rubbish is an invitation to the fire raiser and many reported cases of arson result from ignition of accumulations of leaves, straw, wood, paper etc. in hospital grounds. These fires may damage property and at the very least they will produce irritating smoke which may affect patients and staff. Prompt disposal of general and garden rubbish will reduce the risk.

Safe disposal of flammable liquids

3.12 When it is necessary to dispose of highly flammable liquids it is probably best done by burning them in a suitable open shallow metal container in the open air well away from any building, flammable storage or drains. Incidents have been reported where highly flammable liquids have been emptied into sinks and the vapour issuing from drains or gulleys has caused an explosion. Many solutions and reagents used in pathology laboratories contain sodium azide—these solutions should not be discharged into metal drains because of the risk of explosion. Advice on this matter was given in DS letters 302/72, 59/73, and 168/73. (In Wales "Dear Secretary" letter dated 15 March 1973, reference HSD 44/85/1). Reference should also be made to Waste Management Paper 14 issued by the Department of the Environment. This contains a code of practice for the reclamation and disposal of solvent wastes. Advice should also be sought from appropriate local authority refuse collection departments.

Incineration procedures

3.13 The charging and working of larger incinerators should be entrusted only to competent operators who have received proper instruction on their correct operation. The incinerators should comply with B.S.3316. This British Standard also gives advice on the selection and use of incinerators.

3.14 Certain items are *not* suitable for incineration, e.g. paraffin wax, aerosol cans, because they can cause explosions in incinerators with consequent risk to operators' safety. Vapour remains in an aerosol can after the liquid has been discharged and can expand if subjected to heat causing the can to explode with great force.

3.15 Advice on the handling of aerosol cans was given in Health Equipment Information No. 76, January 1979. An extract is given below:

> *"Health Equipment Information No. 76—January 1979*
>
> 20/79 Pressurised aerosol sprays: the safe disposal of empty cans and general safety precautions.

Because of the continuing reports of accidents and problems in the disposal of pressurised aerosol cans, advice given in HEI No. 17 (item 18/66) and 22 (item 44/67) on their storage, use and disposal is re-issued and amplified.

1. Hospital departments should hold only a number of cans required for immediate use. Additional quantities should be kept in a cool store, preferably one reserved for the storage of highly flammable substances and having adequate low level ventilation.

2. Cans should not be exposed to excessive heat, e.g. direct sunlight, or radiators.

3. Cans should be handled and stored carefully to avoid damage.

4. Aerosols should not be sprayed near naked flames or other sources of ignition.

5. An aerosol can should not be operated when the can is inverted.

6. Manufacturers' warnings printed on the container must always be observed.

7. Under no circumstances may aerosol containers be disposed of by incineration—the resultant explosion may cause injury and considerable damage. Health authorities should ensure that users do not place empty cans in refuse bins, but keep them separately for eventual collection and disposal.

Further information on the safety precautions to minimise the fire/explosion risks associated with aerosol cans is available from the Fire Protection Association, Aldermary House, Queen Street, London EC4N 1TJ.

Enquiries about a particular product are best directed to the manufacturer."

4 Responding to a fire

Signs of fire and the immediate action required

4.1 Common signs of fire are a smell of burning, a crackling, roaring noise and smoke seepage. A door that is hot to the touch is a sure sign that there is a fire on the other side; it should *not* be opened as this will not only allow the fire to spread rapidly but is likely to cause severe burns to the person opening the door.

4.2 The first few minutes are crucial in the development of any fire. The longer it remains undetected the greater is the likelihood that it will become a major conflagration involving loss of life, injury and severe disruption to services. Vigilance and prompt action are therefore essential to ensure early detection, the immediate raising of the alarm and effective "first aid" fire fighting.

4.3 On discovering a fire, the first step is to raise the alarm to obtain help and to alert the switchboard. Local policies will determine when and how the Fire Brigade should be called. Next, remove patients in immediate danger. Then shut all doors to the room affected to prevent or delay the spread of flames and smoke. This action may reduce the supply of oxygen to the fire thus causing it to burn itself out.

Tackling a fire

4.4 Staff should fight a fire if it is safe to do so. Most fires can be easily extinguished if attacked as soon as they start and if suitable fire fighting appliances are to hand and staff know how to use them. (See Appendix 2 for details of fire extinguishers and the fires for which they are intended.) Fires in electrical equipment or installations should not be tackled before the electricity supply has been switched off.

4.5 In general, a person tackling a fire should be between the fire and the nearest means of escape. Staff should be concerned primarily with saving life but well-judged action with the right fire appliance may also save valuable equipment. If there is doubt about safety or if a fire becomes too difficult to fight it should be left to the Fire Brigade.

Dangers of smoke

4.6 In most fires, smoke and toxic gases are a much greater hazard than flames. Most deaths are the result of smoke asphyxiation. Smoke spreads very rapidly, obscures vision and can kill patients and staff who are some distance away from the seat of a fire. Man-made materials used in furniture, furnishings and textiles present a particular hazard because, if ignited, they produce large quantities of hot, toxic, dense black smoke which will quickly obscure vision and thereby prevent fire fighting and evacuation.

5 The use and storage of flammable substances

"Flammable and inflammable"

5.1 Some products in common use are marked "flammable" and others "inflammable"; confusion is known to have arisen as to whether one of these terms is the opposite of the other. They are, of course, synonymous. In order to avoid future confusion authorities concerned with fire safety recommend that "flammable" be used in all cases. It is used throughout this Memorandum.

Flammable liquids

5.2 All flammable liquids give off vapour which under certain conditions and temperatures can ignite. Only those quantities of flammable liquids required for immediate use should be kept in hospital departments. Additional quantities should be kept in a cool ventilated store, preferably one specially reserved for flammable storage, (see paragraphs 5.25 and 5.26 below). Containers should be sealed or capped immediately after use and should not be left standing in direct sunlight or where they may be knocked over. These precautions apply particularly to volatile liquids in common use, e.g. methanol.

5.3 Flammable liquids should not come into uncontrolled contact with open flame equipment or hot surfaces.

5.4 Because of the likely presence of flammable vapour, open flame space heating in laboratories should, wherever possible, be replaced by other methods. Temporary supplementary space heating should be avoided. Work involving the use and release of highly flammable liquids and vapour (as well as gases) should, where possible, be carried out in fume cupboards or fluid pouring cabinets.

5.5 There is a risk from electro-static sparking in areas where flammable anaesthetic agents are in use. This matter and the associated precautionary measures are dealt with in Health Technical Memoranda (HTM) 1 and 2.

5.6 Care should be taken in the use and storage of liquids for domestic cleaning and office use, e.g. floor cleaners, adhesives, floor sealers, correction fluids. When rubber or other floor coverings are laid by means of flammable adhesives, smoking should be prohibited and naked lights, e.g. gas pilot lights and fires which can ignite flammable vapours should be prohibited in the room where such work is carried out and in adjacent rooms and corridors. All windows in the room and doors which communicate with the open air should be opened wide. Doors leading to stores containing flammable materials should be closed. Ignition sources should also be prohibited in rooms below the room or area where the work is carried out because vapours are heavier than air and may penetrate into ducts etc. or through some floors. The least quantity of adhesive necessary for immediate purposes should be brought into the room or building. These precautions should continue until the floor covering is completed and evaporation from the adhesive has ceased. Similar precautions are also necessary during the application of flammable floor sealers.

5.7 Naked flames are the greatest and most likely hazard where oils are in use. "No smoking" rules should

be rigorously enforced. The use of welding equipment, blow torches, etc. should be carefully controlled.

5.8 The risks associated with cooking oils are dealt with in paragraph 6.1.

5.9 The risks associated with paint, thinners and painting processes are dealt with in paragraphs 6.42 to 6.45.

5.10 Aerosol sprays require care because they usually contain a flammable agent and if the spray comes into contact with a flame source a "flame thrower" effect can result. Advice on the use, storage and disposal of aerosol cans is given in paragraphs 3.14 and 3.15.

Misuse of flammable liquids

5.11 Many fires are caused by the misuse and/or careless use of flammable liquids. Examples are the use of petrol for cleaning purposes and the use of paraffin or other flammable liquids, or polish, as a means of assisting an open fire to light or to revive. Many fires, some involving fatalities, have occurred in staff residences as a result of such practices.

5.12 Petrol is a dangerous substance and must *never* be used as a cleaning agent. Other flammable liquids such as methylated spirit and white spirit, whilst having a legitimate use as cleaning agents, should nevertheless be used with care and kept away from open flames and electric fires.

5.13 Clothing which has come into contact with a flammable liquid is a particular danger and can be ignited by a lighted cigarette or through being in close proximity to a gas or electric fire or lighted gas ring.

5.14 Casual attitudes and ignorance in the handling of flammable liquids are a greater danger. Flammable liquids should be treated with respect at all times.

Gases

5.15 Medical gas installations should comply with Health Technical Memorandum 22. The following precautions related to fire taken from paragraph 218 of HTM 22 should be observed:

"The following guidance applies to cylinders used for all piped medical gas and vacuum installations and is also relevant to cylinders used in pathology departments and workshops:

(i) Cylinders should be handled with care. Rough handling may result in damage to cylinders and cylinder valves. They should never be dropped or allowed to come into violent contact with one another or with any hard object. When valve caps are fitted they should remain in place while the cylinder is being moved.

(ii) Cylinders and medical gas installations should be kept as far as possible from all sources of heat and temperatures above 49°C (120°F).

(iii) Oil, grease or other combustible substances should never be used on valves, gauges, regulators or any fitting associated with medical gas cylinders and cylinder installation.

(iv) Valves on new cylinders should be opened cautiously and slowly in order that any leakage may be detected before a serious escape of gas can occur. Tests for leakage should be made by brushing with a frothing detergent."

5.16 Oxygen presents particular hazards. Smoking and the use of open flame equipment should be strictly prohibited if oxygen from a piped supply or cylinder is in use within 6 m. Permanent notices to this effect should be displayed. Patients using oxygen must not be allowed to smoke or have matches whilst the oxygen supply is turned on. In the case of fire, piped oxygen supplies must be turned off when instructed by local management or the fire brigade officer.

5.17 Emergency isolating valves should be clearly marked to identify the gas service and areas served.

5.18 Ethylene oxide is a highly flammable toxic gas. Because of its hazardous nature it should only be used in specialist units where appropriate safety measures have been provided as an integral part of the accommodation. It is about $1\frac{1}{2}$ times as dense as air and mixtures of air in concentrations of 3 per cent or more by volume are flammable. For cold sterilizing processes it should be used only with a diluent to reduce the flammability of the mixture. A 13 per cent ethylene oxide 85 per cent CO_2 mixture is frequently used. This mixture is flammable in certain combinations with air and those concerned with the handling and use of this gas mixture should be made aware of the flammability hazards. The following precautions should therefore be observed:

5.18.1 Avoid exposure to heat.

5.18.2 Ensure that the purging of equipment and venting of sterilized equipment including the venting of relief devices, is carried out in a safe area.

5.19 Hyperbaric oxygen chambers may be pressurised with oxygen up to 3 atmospheres (30 p.s.i. gauge—2 Bar). Pressurization increases the fire risk still further and in an emergency it will take an appreciable time to remove an occupant. Therefore, the most stringent fire precautions to avoid ignition are necessary in and around hyperbaric oxygen chambers. Oxygen which is exhausted or released from hyperbaric oxygen chambers should be dispersed safely to prevent the possibility of high oxygen concentrations in the event of an emergency release of oxygen from the chamber. This can be achieved by piping outlets direct to the atmosphere or by providing adequate mechanical extract ventilation in areas communicating with chambers. Fire extinguishers for use in the vicinity of hyperbaric chambers must have sufficient operating pressure to be effective in the higher ambient pressures.

Liquefied petroleum gases (LPG)

5.20 Regard should be paid to the Highly Flammable Liquids and Liquid Petroleum Gas Regulations SI 1972–917. The Home Office Fire Prevention Guide No. 4—Safe Use and Storage of Liquefied Petroleum Gas in Residential Premises is highly recommended to all who use LPG appliances, paragraph 3.8 and Sections 8 and 9 are of particular relevance. Health & Safety Executive Guidance Note CS 4—The Keeping of LPG in Cylinders and Similar Containers is also of relevance.

5.21 Commercially marketed LPG is stored in liquid form under pressure in suitable metal containers. When LPG escapes in liquid form it vaporises rapidly, forming a flammable gas-air mixture. The most common LPGs used for heating, cooking and lighting purposes are propane and butane. These gases are appreciably heavier than air and if they escape will gravitate to floor or ground level and concentrate unless there is adequate low level ventilation to disperse and dilute them. Escaping gas can enter drains and collect in pits, ground depressions or under suspended floors at ground level.

5.22 The flammability limits of propane and butane in air are in the order of:

Propane—2·2% (lower limit) 9·5% (upper limit).
Butane —1·8% (lower limit) 8·5% (upper limit).

These are the percentages by volume of gas present in a gas-air mixture which will produce an ignitable vapour. A concentration of gas less than the lower limit or greater than the upper limit does not produce an ignitable vapour.

5.23 The contents of LPG cylinders can be identified as follows:

red cylinder—propane.
blue or green cylinder—butane.

It is becoming standard practice to fit pressure relief valves to LPG cylinders but there are still cylinders in use which do not have such valves fitted. If exposed to excessive heat an unrelieved cylinder may explode but if a suitable relief valve is fitted this possibility is virtually eliminated. An "empty" cylinder is still potentially dangerous. One of the main reasons is that in this state the internal pressure is approximately atmospheric, and should the valve be leaking or left open, air can enter the cylinder and may form an explosive mixture with the gas remaining therein.

5.24 The potential danger from LPG is such that the release of about 1·0 kg. of gas into a room 3 m. by 3 m. by 3 m. will, when the gas is thoroughly mixed with air, create an explosive mixture throughout the whole of the room.

5.25 Portable LPG heaters present particular hazards. In general, they are not recommended for use in patient areas and areas of high fire risk. Where they are in use they should be sited away from draughts and not be placed within one metre of combustible material. Preventive maintenance procedures should be adopted by the Works Department and strictly observed. (See paragraph 6.54 below.)

5.26 The maintenance of LPG installations and appliances, including portable heaters, is the responsibility of Works Departments. Advice on maintenance procedures is given at paragraphs 6.54 and 6.55.

Storage of flammable substances

5.27 Flammable liquids and other flammable substances, particularly foam plastics, should be stored in a special enclosure reserved for the purpose. Advice on storage procedures is obtainable from the Fire Brigade and the Health & Safety Executive. Detailed guidance is given in Health & Safety Executive Guidance Note CS2—The Storage of Highly Flammable Liquids. Anti-static precautions should be observed.

5.28 Highly flammable liquids should be stored alone so as not to endanger less hazardous material which, if ignited, could contribute to a fire. For the relatively small quantities usually required by hospitals, adequate storage of flammable liquids may be afforded by a storeroom which is either a separate building or a fire-resisting compartment of a building accessible only from the open air. In either case, the storeroom should be sited where, in the event of a fire in the store, the means of escape from nearby buildings will not be prejudiced. Permanent high and low level ventilation should be provided to the outside air. Provision should be made to prevent any possibility of an outflow of the contents; this may be achieved by means of a raised brick sill of sufficient height constructed across the doorway. Doors should open outwards. The stores should be marked "Highly Flammable Material". The storage facilities should be commensurate with the fire risk. If large amounts of flammable liquids are involved, storage in a safe position in the open air is preferable, as recommended in Health & Safety Executive Guidance Note CS 2.

5.29 Storage of petrol is regulated by the Petroleum (Consolidation) Act, 1928. Although health authorities are exempted from obtaining a licence, arrangements for the storage of petrol should nevertheless comply with the requirements of the local licensing authority. Advice on the storage of petroleum spirit is obtainable from the Fire Brigade.

5.30 All shelves and other fixtures should be of non-combustible construction.

Disposable goods

5.31 The increasing use of disposable items, many of paper and some of plastic, can significantly increase fire risks unless appropriate precautionary measures are taken, for example:

5.31.1 The storage of paper and other flammable items should be restricted to amounts which are

required for current use and be kept in cabinets or containers of non-combustible construction. Additional quantities should be stored in rooms which are constructed and equipped for storage of combustible material.

5.31.2 Paper or plastic refuse sacks should be mounted on a fixture which has a self-closing lid. If located in a staff or patient area, or in corridors, refuse sacks should be completely housed in a non-combustible container or fire resisting enclosure, e.g. a metal bin with a well-fitting, self-closing, metal lid.

5.31.3 A conspicuous notice should be provided warning against putting lighted cigarettes or matches in the containers.

5.31.4 Arrangements should be made for full sacks to be disposed of without delay.

Other potential hazards

5.32 Other potential hazards are:

5.32.1 Oxidation of oils and fats left on combustible materials such as cotton, wool, rags, etc.

5.32.2 Generation of static electrical charges in quantities sufficient to produce sparking, e.g. by the flow of dry gases, dusts or combustible liquids in pipes (e.g. benzine or light petroleum) in conjunction with production of flammable vapour. Dust can be a real problem in some pharmaceutical operations and explosions caused by a spark have been known especially where starch and dextrin are present.

5.32.3 Precautions are also necessary where there is plastic splinting which involves the use of flammable solvents. Electric hairdryers should not be used to dry such materials.

5.33 For advice on the safe disposal of flammable substances see paragraph 3.12.

6 Fire hazards of various hospital departments and appropriate precautionary measures

Kitchens

6.1 Fat fryers constitute one of the main fire risks in hospitals. Oils and fats give off vapours which can be readily ignited, e.g. by gas burners if overheating occurs. (See Appendix 3 for details of the approximate critical temperatures for various cooking oils and fats.)

6.2 Spontaneous ignition has been known to occur at very high temperatures, especially when equipment is left unattended. Fat fryer fires are particularly fierce and can be very dangerous; spitting hot fat often deters attempts to tackle a fire.

6.3 A fire blanket should be provided at a convenient point and staff should be instructed in its use. The importance of using the correct techniques for dealing with fat fryer fires cannot be overstressed. Under no circumstances should water be used to extinguish or otherwise come into contact with such fires. Precautionary measures against the risks associated with fat fryers are dealt with in Appendix 3.

6.4 In kitchens it is always desirable to extract fumes from fat fryers through a separate extractor system. By this means the length of ductwork which is likely to be contaminated by grease will be minimised and the possibility of a fire and damage from it reduced.

6.5 Any canopy over a fat fryer should be constructed of sheet metal and have a smooth surface. If a large volume of oil or fat is to be used the fryer should be placed away from other equipment if possible. Grease eliminators should be provided in the extract and for multi-pan fryers, there should be one extract point and grease eliminator for every two pans. Fire dampers are not required. The extract system should continue to operate in the event of a fire to assist in containing the flames and clearing smoke.

Laundries

6.6 The fluff which collects in laundries can, if ignited, result in the rapid spread of fire. It should not be allowed to accumulate. In addition to the regular cleaning of the more accessible places, fluff should be removed regularly from electric motors, heating coils, tumbler ducts and roof trusses.

6.7 The minute textile fibres comprising such fluff or lint are prone to ignite spontaneously when impregnated with oil, wax or other greasy residues particularly if adjacent to sources of heat. The areas under calender beds, and around the operating mechanisms of cabinet garment finishing machines, are particular danger points.

6.8 Spontaneous combustion is caused by the temperature of the work rising due to slow oxidation of the textile fabric within the load. The risk is increased with hot work taken straight from a tumbler dryer or calender and tightly packed in trolleys or trucks, and the presence of residues of oil, grease, wax, soap, rubber or similar materials on the fabric will further increase the danger.

6.9 Tumbler dried work has been a major cause of fires due to spontaneous combustion and special attention should be paid to operating procedures:

6.9.1 Work should not be overdried in the tumbler.

6.9.2 Work should not be left in the tumblers after the drying process is finished, but should be unloaded immediately.

6.9.3 Tumblers must always be unloaded and left in an empty state overnight.

6.9.4 Tumbler dried work should be separated and folded as soon as possible after removal from the tumbler. If this cannot be done the work should be removed from the tumbler and spread out in such a way that the heat is quickly lost.

6.9.5 Ideally, tumblers should be equipped with manual, or preferably automatic, means for cooling the load at the end of the drying cycle.

Physiotherapy departments

6.10 Fires have been attributed to the overheating of physiotherapy wax baths which have been left switched on overnight to obviate "warming up" prior to operation. The fire risk can be reduced by using a time switch to control the socket outlets used with wax baths.

6.11 Because of the highly flammable nature of the wax, special attention should be given to the use of thermal safety devices on these appliances. In addition to a thermostat to control the temperature over a range safe for the patient (maximum 50°C) a manually re-setting type should be provided which should be pre-set to trip at a safe temperature (60°C maximum) and to ensure that no overheating occurs when the bath is empty or partly filled. The temperature limits of control are determined by patient safety as well as fire risk; operating temperature range is 45–50°C, overheating occurs at 55–60°C.

6.12 The sterilising of physiotherapy wax by heat can constitute a serious fire risk unless carried out in suitable non-combustible surroundings under proper supervision. Suitable fire extinguishing apparatus should be at hand, e.g. a 10 litre (2 gallon) foam type or 4·5 kg. (10 lb.) powder type extinguisher.

X-ray departments

Radio-active materials

6.13 In general, rooms which contain radio-active materials are of substantial construction to minimise radiation hazards and this protection will provide an effective barrier against fires originating outside the rooms. Furthermore, there is no inherent significant fire risk associated with radio-active sources and if appropriate steps are taken to eliminate the use of flammable materials within the rooms, the risk of fire should be slight.

6.14 The effect of fire in these areas, however, may present a serious risk to fire fighting personnel in the event of the special defences against radiation being destroyed, e.g. by causing lead shielding to melt, see paragraph 6.21.

X-ray film storage

6.15 Since 1941, all x-ray film produced in this country has a cellulose acetate base and it is classified "non-flam" although it will burn slowly. Prior to this date x-ray film made of cellulose nitrate was available, and this type of film is very highly flammable and is explosive at slightly raised temperatures. The number of nitrate films which it will be necessary to retain should be small.

"Non-Flam" (acetate) film storage

6.16 The fire risk associated with this type of film is of the same order as that of paper. Steel cabinets are considered to be the most suitable containers for the storage. Naked lights and other igniting agents should not be permitted in the storage area.

6.17 If film is not to deteriorate in storage the store-room temperature should not fall below approximately 10°C (50°F) and low temperature type heating should be used. Electric heaters should be of an enclosed convector type installed at a high level and controlled by a room thermostat.

Nitrate film storage

6.18 Nitrate film should be stored in totally enclosed metal containers with tight fitting lids and should be conspicuously marked "Highly Flammable" in red lettering. Stocks exceeding 35 kg. (80 lb.) should be stored in a room of fire resisting construction which is reserved exclusively for this purpose and well ventilated direct to the outer air. The store should preferably be located in the open, well away from other buildings. It should be kept cool because nitrate film can decompose after lengthy storage, particularly in a warm temperature.

6.19 The door to the store must be permanently and conspicuously marked "Film Store—No Smoking".

Doors

6.20 All doors must be closed during periods when the rooms are not in use, particularly at night.

Fire procedure

6.21 The local Fire Brigade must be fully informed of the location and risk to firemen of all radio-active sources in the hospital and all rooms and areas containing radiation hazards must clearly display radio-activity (Trefoil) symbols. The method to be adopted in fighting fires at these locations including first-aid measures, should be agreed between the hospital physicists and the Chief Fire Officer. Where considered appropriate, a notice indicating the most suitable type of fire appliance could be located adjacent to the warning symbol referred to above.

6.22 Each hospital using radio-active material and equipment should have trained personnel available on a 24-hour basis to advise and guide the officer in charge of the attendant fire brigade in the event of a fire on

the premises. During the first half-hour or so, following an outbreak of fire, the above duties may be assumed by a member of the resident staff (for example, radiographer or engineer) pending the arrival of the physicist who has special responsibility for the safety of the radio-active material in the hospital.

6.23 Gloves and other protective clothing must be provided at strategic points outside the risk areas, and should be readily accessible in case of emergency, either for the use of the resident staff or firemen. (Not all brigades carry protective clothing as part of their standard equipment.) After use, the gloves and other clothing must be washed down with clean water and monitored for radiation.

6.24 The hospital fire plan should provide for the appropriate radiation-monitors to be available. Officers in charge of fire-fighting and their operating personnel must not enter a controlled area as defined in the Code of Practice for the Protection of Persons against Ionising Radiations arising from Medical and Dental Use unless accompanied by the official who is nominated by the hospital and who is equipped with radiation-monitoring equipment.

Laboratories

6.25 Most fires in laboratories arise from accidents with highly flammable substances. Advice on the use and storage of such substances is given in paragraphs 5.1 to 5.28. Advice on the safe disposal of flammable liquids is given in paragraph 3.12. Oxidising agents such as perchloric acid require particular care. Although most of these agents are not flammable, they will oxidise many materials with which they come into contact, particularly following spillage or leakage, and greatly increase the risk of an intense fire or explosion. The hazards of perchloric acid are dealt with in DS 164/75 and HN (76)95. (In Wales DSW 164/75 and WHN (76)87.) Explosions are also possible if flammable solvents or specimens treated with such solvents are stored in domestic type refrigerators because accumulations of flammable vapour can be exploded by the normal operation of the electrical circuit. If it is necessary to store such solvents and treated specimens in refrigerated conditions a refrigerator designed specifically for the purpose should be used.

Unattended apparatus

6.26 Special precautions are necessary where equipment is left connected to the supply during non-working hours, particularly where such equipment incorporates heating facilities and there is a possibility of overheating. In these instances a pre-set thermal cut-out should be provided in addition to the normal thermostatic control. Where it is normal to leave electrical equipment in unattended use it is desirable to install automatic fire detectors.

Fire appliances

6.27 Adequate hand-operated fire appliances are essential. Powder and carbon-dioxide extinguishers are probably the most suitable for laboratories.

6.28 In laboratories handling categories A & B1 & B2 materials, which may be highly contagious, the laboratory doors must show an international BIO-HAZARD sign. In addition, doors on equipment and specimen cupboards must have labels marked "Danger of Infection".

6.29 The fire prevention officer must inform the local fire officer in advance of the special hazard associated with these departments. In the event of a fire the safety officer, his deputy or any other responsible person in the department, should be urgently contacted and his advice sought.

Domestic Services Management (DSM)

6.30 Documents which are of some relevance to fire precautions are DSM Advice Notes 1 (Cleaning frequencies in acute and general hospitals) and 3 (General guide to the Management of Domestic Services in the NHS) and Estmancode, Volume 2, Chapter II, Section 8.

6.31 Wall and other internal surfaces can play an important part in the spread of flame. The speed with which flame will spread is determined largely by the type of finish, e.g. gloss paint, emulsion paint etc. applied but the existence of dust, grease etc. on walls will aid the spread of flame and production of smoke. Cleaning policies and procedures should therefore take account of these factors.

6.32 The need to avoid the accumulation of rubbish is referred to at paragraph 3.6 above.

6.33 Ventilation hoods above deep fat fryers are a particular fire risk because of the accumulation of fats and grease. Estmancode Volume 2, Chapter II, Section 8 recommends a periodic "deep clean" of kitchens and kitchen equipment.

6.34 For advice on the disposal of waste materials and incineration procedures see paragraphs 3.7 to 3.15.

Works departments

6.35 There should be close co-operation between works departments and the fire prevention officer so that the latter is aware in advance of the details of maintenance and other work to be undertaken particularly if hazardous processes are to be used, and if outside contractors are to be employed.

Fire hazards during building operations

6.36 Buildings undergoing major alterations, repair or maintenance and those under construction are particularly vulnerable to fire because:

6.36.1 Structural fire and smoke barriers such as

walls, doors, floors, fire protective finishes or ceilings may be incomplete or removed.

6.36.2 Flammable rubbish such as wood shavings and sawdust may accumulate. Some building operations also generate explosive or potentially explosive dust.

6.36.3 Combustible building materials may be stored or in use.

6.36.4 Techniques employed may involve welding, flame producing equipment, flammable liquids, adhesives or other potentially dangerous processes.

6.36.5 Fire protection equipment designed for the ultimate protection of the building may not be installed or operational.

6.36.6 Escape routes may become obstructed.

6.36.7 In occupied buildings, patients, staff and visitors could be put at risk by a fire originating in the area where building work is taking place. Staff working in departments where building work is to be carried out should be advised of the increased fire hazards.

Fire safety and outside contractors

6.37 Outside contractors are a greater fire risk than NHS staff because they are not as familiar with the premises as people permanently employed and therefore cannot be expected to know the fire risks, necessary precautions and action to be taken in the event of fire. Contractors may have to carry out work which is much more hazardous than that normally carried out on the premises. Therefore, every effort should be made to make all contractors aware of the particular risks their work involves in a hospital environment.

6.38 The activities of contractors should be strictly supervised and controlled and works officers should ensure that all necessary precautions against fire are taken.

6.39 The Department of the Environment Booklet P5—"Standard Fire Precautions to be taken by contractors engaged on building and engineering works and maintenance for the Department of the Environment Property Services Agency" is a useful checklist for works officers of fire precautions which contractors should observe.

Building maintenance

6.40 The principal reference document on building maintenance is Estmancode, Volume 2, Chapter II, Section 3.

6.41 Protected areas, corridors and other areas which provide means of escape must be carefully maintained so as to provide the required resistance to fire and smoke. Fire doors should fit closely to the correct tolerance in order to prevent smoke escaping from a fire compartment or sub-compartment long enough to enable patients and staff to escape from danger. Ill-fitting windows should be attended to so that in the event of fire they will not admit air currents to feed a fire and spread smoke.

6.42 Painting processes introduce a fire hazard because:

6.42.1 Oil bound paints are flammable and thinners, stripping liquids and cellulose paints often contain highly flammable ingredients, and

6.42.2 Blow-lamps used for paint stripping may cause smouldering fires in hidden places.

6.43 Decanting of paint, thinners and stripping liquids should not be carried out in the vicinity of an open fire or other source of ignition. Caps and lids should be replaced on all containers when they are not in use. Only a sufficient quantity of paint for day to day work should be drawn from store; tins (including empties) should be returned to the store at the end of each day. During paint stripping, deposits of stripped material should be collected at the end of each day and disposed of safely. Rags which have become impregnated with paint, thinners, stripping liquids or linseed oil should be collected daily and placed in a metal container with a lid pending safe disposal.

6.44 Care should be taken during painting work in the vicinity of pipes carrying flammable liquids and gases; in particular, aluminium based paints should not be used. Thermite can be evolved by the combination of iron oxides (rust) and aluminium powder and this can be ignited by a spark produced, for example, by a spanner dropping on to a hard surface or by gas cylinders being knocked together.

6.45 When blow-lamps are used on painting operations or any other maintenance work the following precautions should be observed:

6.45.1 Never leave a lighted blow-lamp unattended.

6.45.2 Check that flames from blow-lamps do not reach surrounding combustible material particularly in roof spaces and "hidden" places such as eaves and within the framework of sash windows. Recheck before leaving the premises to ensure that there is no evidence of smouldering behind woodwork.

6.45.3 Avoid using a blow-lamp near curtains or drapes which might be blown on to the flame and ignite.

6.45.4 Ensure that any burning paint strippings are immediately extinguished.

6.45.5 Have a bucket of water or water extinguisher at hand to douse any fire which might be started.

6.46 After maintenance work has been carried out, care should be taken to restore the building elements to their former position and/or condition, e.g. suspended ceiling sections and access covers should be replaced properly. Failure to observe this practice could result in smoke and toxic gases being freely released into an escape route corridor via ducts or voids above the corridor. Work on pipes and ducts should include restitution of fire stopping materials or dampers. The fire standard of surface finishes with regard to spread of flame should not be reduced as a result of maintenance work.

Engineering maintenance

6.47 The principal reference documents on engineering maintenance are Estmancode, Volume 2, Chapter II, Section 2 and the associated maintenance manuals PMG 12 and PMG 13.

6.48 Fire alarm systems should be maintained on a preventive basis in accordance with PMG 12, Section E6. Advice on the maintenance and cleaning of heat and smoke detector leads is contained in HTM 82, Section 12.

6.49 Fire fighting equipment should be maintained on a preventive basis in accordance with PMG 13, Section M8.

6.50 Ventilation shafts and mechanical systems such as roof louvres or shutters should be inspected regularly and tested for proper functioning. They may be used to keep an area free of smoke for evacuation purposes in the event of fire, or for venting of fire, smoke and toxic gases.

6.51 Control gear for engineering installations, i.e. gas, water and electricity, should be clearly labelled as to the spaces etc. supplied, and readily accessible to the appropriate staff at all times. Accessibility should not, however, be such that tampering by unauthorised persons is facilitated.

Maintenance—general

6.52 The dirt and rubbish which can accumulate in service ducts, voids and roof spaces presents a serious fire hazard. These spaces should be inspected regularly and kept clean. Disused ducts should, wherever possible, be sealed but ventilated where this is necessary.

Liquefied petroleum gas (LPG) installations

6.53 General advice on LPG and references to specific guidance documents is given in paragraphs 5.20 to 5.26 above.

6.54 The responsibility for maintaining LPG installations including any portable heaters, lies with the Works Department and specialist advice should be obtained where necessary. Most suppliers of LPG and associated appliances operate service schemes which include:

6.54.1 A periodic inspection of the installation and associated connected equipment. This includes tests for gas leakage, correct adjustment to ensure efficient use of fuel and damage to or deterioration of the insulation and equipment. Estmancode maintenance manual PMG 13, Section M5 is relevant in this respect.

6.54.2 Advice to staff on the correct use of equipment and on the replacement or repair of damaged equipment.

6.54.3 Emergency call-out service to cover failure of the installation or its associated equipment.

6.55 Particular care should be taken when using LPG appliances for maintenance purposes in corridors, passageways and assembly areas. Where such corridors etc. are part of an escape route, adequate arrangements should be made to preserve the integrity of the means of escape.

Electrical services

6.56 Electrical installations should be maintained in accordance with Estmancode, Volume 2, Chapter II, Section 2 and maintenance manual PMG 12. Regular testing and servicing of electrical installations should include electrical resistance and earth continuity tests as prescribed in the Regulations for the Electrical Equipment of Buildings published by the Institution of Electrical Engineers.

6.57 Where electrically heated appliances such as film processing units, incubators and drying rooms are liable to be kept switched on whilst premises are unoccupied, a manual re-set thermal cut-out should be provided in addition to the control thermostat.

6.58 Temporary and improvised wiring is potentially dangerous and should be avoided where possible. Where its use is justified, it should comply with the requirements of the Institution of Electrical Engineers "Regulations for the Electrical Equipment of Buildings". Permanent wiring should be used for installations which will be required for more than three months.

6.59 Switchrooms should be free from storage of items other than electrical components which may be required in an emergency. Fire precautions for HV and MV switchrooms and for transformer chambers are included in HTM 7—Electrical Services, Supply and Distribution.

6.60 Battery rooms should have adequate permanent ventilation direct to the outer air and a prominent "no smoking" notice displayed. Naked flames should not be brought near batteries whilst they are being charged.

6.61 Improvised arrangements made during power failures can increase fire risk. The provision of emergency electrical supplies is dealt with in HTM 11—Emergency Electrical Services. In those parts of hospitals in which emergency lighting is not installed, portable battery-operated lanterns should be provided.

Appendix 1

FIRES OCCURRING IN HOSPITALS IN A TYPICAL RECENT YEAR SHOWING PLACE OF ORIGIN, SOURCE OF IGNITION, MATERIAL IGNITED AND NUMBER OF CASUALTIES

A1.1

Place of origin	*Number of fires*	*Number of "life-risk" fires*
Ward	557	32†
Bedroom*	69	5†
Hall, corridors, stairs	160	1†
Bathroom WC	213	7†
Lounge, common room	143	8†
Kitchen	272	2
Store	124	5
Laundry	87	2
Other	459	2
Not stated	135	6
	2,219	70

* Bedroom may include some small side wards or nurses'/doctors' accommodation within the hospital.
† Areas to which patients have access.

A1.2

Source of ignition	*Number of fires*	*Number of "life-risk" fires*
Smokers' materials	739	33
Malicious or intentional ignition	420	14
Cooking appliances	189	2
Matches	89	8
Other	656	8
Unknown	126	5
	2,219	70

A1.3

Materials ignited	*Number of fires*	*Number of "life-risk" fires*
Bedding	282	21
Other textiles, furniture or furnishings not elsewhere stated	358	9
Paper, packaging, waste materials	654	10
Food	152	2
Liquids and gases	58	5
Clothing on person	13	11
Other	518	4
Unknown	184	8
	2,219	70

Appendix 1 continued

A1.4

Casualties (place of origin)	*Fatal*	*Non-fatal*
Wards, bedrooms	6	24
Other areas to which patients have access	1	8
Other areas	–	15
	7	47

A1.5

Casualties (age)	*Fatal*	*Non-fatal*
Under 15	–	–
15–64	4	33
65 and over	3	12
Not stated	–	2
	7	47

The foregoing figures, compiled by the Fire Research Station, relate to fires in hospitals in the United Kingdom in 1976 which were reported to fire brigades.

More detailed information is contained in: "Some Trends in Hospital Fire Statistics", S. E. Chandler, Fire Research Station. (Building Research Establishment Current Paper CP67/78).

Appendix 2

Types of Fire Extinguisher

Type	*Use for fires*		
	In ordinary combustible materials	*In flammable liquids*	*Where there is an electrical risk*
Water gas pressure	√	—	—
Water stored pressure	√	—	—
Water soda/acid	√	—	—
Dry Powder	—	√	√
Foam mechanical	—	√	—
Foam chemical	—	√	—
Carbon Dioxide	—	√	√
Vaporizing Liquid			
C.B.M.*	—	—	√*
B.C.F.*	—	√*	√*
B.T.M.*	—	—	√*

* It should be noted that when these are used as extinguishants in confined spaces the fumes and the products of combustion are toxic and may be dangerous.

Appendix 3

FIRE PRECAUTIONS—FAT FRYERS

Fire Risk

A3.1 Of all equipment used in hospitals, fat fryers are most frequently involved in fires and the commonest cause of these fires is the overheating of the oil or fat in the fryers.

A3.2 When oils or fats are heated above certain temperatures (see the table below) a flammable vapour is formed which can be readily ignited, e.g. by the burners. At still higher temperatures spontaneous ignition will occur which can be terminated only by a rapid lowering of the temperature or the exclusion of oxygen for combustion. The large amount of oil or fat contained in many fat fryers is capable of supporting a fire for a period long enough to cause considerable damage. For safe operation, therefore, the temperature of cooking media must be held at levels below their respective flash points. This is best done by the use of reliable, automatically operating overriding thermostats. Even so, adequate and suitable means of extinguishing a fire must be available close to every fryer.

Operation and maintenance

A3.3 Misuse of fryers helps to cause fires, and it is important that all catering staff receive proper instructions on the correct method of operation.

A3.4 Oil or fat should be maintained at the correct level; overfilling increases splashing when food is lowered into the fat; a low oil or fat level may prevent the thermostat from working and seriously increase the risk of overheating and fire.

A3.5 On no account should the pan heater be left on when draining used oil or fat from the pan.

A3.6 Care is required when solid fat such as dripping is introduced into an empty pan because until a sufficient quantity of fat has melted to cover the sensitive elements of the thermostats these devices may be inoperative.

A3.7 When the type of cooking fat or oil is changed it is possible that the new type may have a different flash-point from that previously used. The hospital engineer should be informed when a change is made so that the overriding thermostats can if necessary be re-set. Oils and fats of different types should not be mixed.

A3.8 Good maintenance is essential to reduce fire risk. Even the most reliable apparatus will fail in due course if it is not regularly inspected and overhauled and if the controls are not kept correctly adjusted. The Estmancode maintenance manual PMG 13 includes procedures for fryers and other kitchen equipment.

A3.9 Correct functioning of both thermostats is extremely important: operating temperatures should be checked. Diaphragms of relay valves can stiffen with age and fail to function.

A3.10 Fatty deposits should be removed frequently from dampers and surrounding ductwork, and dampers operated by a fusible link should be checked for freedom of movement and correct balance.

A3.11 Regular cleaning of the hob and surrounding metal work, the hood, sides and back of the fryer, duct-work, fan blades and any filters is essential. Periodic inspection of all controls and fire fighting equipment is essential.

Fire extinguishers

A3.12 It is essential that fire extinguishing apparatus is close at hand. The most suitable portable extinguishers are foam types and fibreglass blankets. At least one of each should be situated near each fryer.

A3.13 In addition to the use of fibreglass blankets the pan covers themselves should be used initially to smother a fire. A long metal rod should be provided to allow the remote operation of the pan covers in the event of fire.

A3.14 Kitchen staff do not always know where the fire fighting equipment is or how to use it. Experience shows that it is usually when relief kitchen staff are on duty, or when a kitchen is under-staffed, that fryers are left unattended and fires are more likely to occur.

A3.15 In the event of fire, some or all of the following action should be taken:

a. Raise the alarm.

b. Turn off the gas isolating cock or electricity mains isolating switch.

c. If pan covers are provided, they should be placed over the pans and covered by a fibreglass blanket to prevent the fire spreading. If covers are not available, fibreglass blankets should be used.

d. Any flames should be tackled with foam extinguishers if it is safe to do so.

e. Close doors and windows.

Causes of fires

A3.16 The causes of fires vary but they have mostly been due to one or more of the following:

a. Night staff, when on duty alone, leaving the apparatus alight whilst working out of sight.

Appendix 3 continued

b. Covers of fryers being closed on to hot oil or fat between separate cookings.

c. Fryers without overriding thermostats or with faulty thermostats.

d. Fryers with overriding thermostats set at temperatures above the flash point of the type of oil or fat being used. This may be due to cooking oil or fat being changed—particularly where a change is made to dripping which has a lower flash point.

e. A common but less well understood cause is the use of fryers with insufficient oil or fat to cover the thermostat element. In these circumstances the thermostat does not always operate and serious fires have resulted even with new equipment.

f. Gas-heated fryers cause more fires than electric ones because of the presence of flame and they can be dangerous if not kept clean.

Table **Approximate critical temperatures for various cooking oils and fats**

	Smoke point °C(°F)	*Flash point °C(°F)*	*Fire point °C(°F)*
Groundnut oil	202 (395)	250 (482)	335 (635)
Corn oil	199 (390)	243 (469)	321 (610)
Lard	205 (400)	275 (527)	326 (619)
Dripping	154 (310)	246 (475)	331 (628)
Hydrogenated cooking fats	190 (375)	228 (442)	331 (628)

NOTES

Normal frying temperatures fall within the range 163°–188°C (325°–370°F). Overheating degrades the oil or fat causing it to darken, thicken and foam and develop an "off" flavour.

Smoke point is measured in accordance with BS 684. The temperatures quoted refer to use while cooking; for fresh fats and oils heated alone, smoke points may be some 10°C (50°F) lower.

Flashpoint is the lowest temperature at which vapours can be ignited in a specific test method. Although combustion is not maintained at this temperature, there is still a danger of explosion and/or fire. Fire point is the lowest temperature at which self-supporting combustion can be maintained under test conditions.

Auto-ignition (spontaneous ignition) temperature is that at which vapours ignite in a heated vessel without an ignition source present. Auto-ignition temperatures are greater than the respective flash points but do not correlate directly with fire points.

The temperatures quoted in the table refer to oils and fats heated in the pan alone; while cooking is in progress, flash points tend to be raised slightly due to steam in the vapour. On the other hand, flash points can be reduced markedly when oils and fats become degraded or contaminated.

In general, any temperature higher than the respective smoke points should be regarded as potentially hazardous.

Appendix 4

SELECT BIBLIOGRAPHY

(Items marked * are obtainable from HM Stationery Office, enquiries about other items should be addressed to the organisations mentioned in the respective titles).

ACTS OF PARLIAMENT AND STATUTORY INSTRUMENTS

*Fire Precautions Act, 1971.
*Factories Act, 1961.
*Health and Safety at Work etc., Act, 1974.
*Petroleum Consolidation Act, 1928.
*SI 1972, No. 917—The Highly Flammable Liquids and Liquefied Petroleum Gases Regulations, 1972.

DHSS/WELSH OFFICE GUIDANCE

Circular HC(78)4—WHC(78)24 in Wales—The Organisation and Management of Fire Precautions in the National Health Service.

DS letter 302/72, 59/73, 168/73 (in Wales—"Dear Secretary" letter HSD/44/85/1 dated 15 March 1973) } Dangers of Explosions in laboratory drains from solutions containing azide.

"Dear Engineer" letter ED75/38—Test Running of Standby Generators.

DS 164/75 (DSW 164/75 in Wales)
HN (76) 95 (WHN(76)87 in Wales) } Use of Perchloric Acid.

*Health Technical Memoranda (HTM)

1 Anti-static precautions: rubber, plastics and fabrics.
2 Anti-static precautions: flooring in anaesthetising areas.
7 Electrical Services, Supply and Distribution.
11 Emergency Electrical Services.
22 Piped Medical Gases, Medical Compressed Air and Medical Vacuum Installations.
26 Commissioning of Oil, Gas and Dual Feed Boilers.
81 Fire Safety in Health Care Premises—Planning and Design of New Buildings.
82 Fire Safety in Health Care Premises—Fire Alarm and Detection Systems.
84 Fire Safety in Personal Social Services Premises—Planning and Design of New Residential Accommodation for the Elderly.
85 Fire Safety in Health Care Premises—Means of Escape in Existing Buildings.

ESTMANCODE—Estate Management (Building, Engineering and Grounds) Practices Code for the National Health Service.

Volume 2, Chapter II, Section 2—A System of Planned Preventive Engineering Maintenance.
Volume 2, Chapter II, Section 3—System of Surveys, Forward Inspections and Planned Preventive Building Maintenance.
Volume 2, Chapter II, Section 8—Relationship between Cleaning and Maintenance of Health Buildings.
Maintenance Manual—PMG 12—Electrical.
Maintenance Manual—PMG 13—Mechanical.
Engineering Data Sheet MW 2.1—Disposal of Hospital Waste.

DSM Advice Notes

No. 1 Cleaning Frequencies in Acute and General Hospital.
3 General Guide to the Management of Domestic Services in the National Health Service.

Health Equipment Information 76—January 1979 item 20/79 Pressurised Aerosol Sprays.
*Code of Practice for the Protection of Persons against Ionising Radiations arising from Medical and Dental use.
Fire Precautions Development Programme.

OTHER GOVERNMENT DEPARTMENTS' PUBLICATIONS

Home Office—Guide to Fire Precautions in Hospitals.
*Home Office—Fire Prevention Guide No. 4—Safe Use and Storage of Liquefied Petroleum Gas in Residential Premises.

Appendix 4 continued

Department of the Environment

*Waste Management Paper 14.

*Property Services Agency. Booklet P5—Standard Fire Precautions to be taken by contractors engaged on building and engineering works and maintenance for the Department of the Environment, Property Services Agency.

Building Research Establishment

Current Paper CP67/78—Some Trends in Hospital Fire Statistics, S. E. Chandler, Fire Research Station.

Health and Safety Executive

*Guidance Note CS 2—The Storage of Highly Flammable Liquids.

*Guidance Note CS 3—Fire Risk in the Storage and Industrial Use of Cellular Plastics.

*Guidance Note CS 4—The Keeping of Liquefied Petroleum Gases in Cylinders and similar Containers.

*Guidance Note EH 7—Petroleum Based Adhesives in Building Operations.

*Guidance Note EH 9—Spraying of Highly Flammable Liquids.

*Health & Safety (General) Booklet Series No. 3—Highly Flammable Materials on Construction Sites.

OTHER REFERENCES

British Standards Institution

BS 684—Methods of Analysis of Oils and Fats.

BS 3316—Large Incinerators for the Destruction of Hospital Waste.

BS 5266—Code of Practice for the emergency lighting of premises.

BS 5724/1—Requirements for general safety, transport, storage, installation and maintenance of medical electrical equipment.

Institution of Electrical Engineers

Regulations for the Electrical Equipment of Buildings.

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